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MET35 --- ELECTRICAL AND ELECTRONICS ENGINEERING

2 MARKS (QUESTION & ANSWERS)

UNIT 01 (Transformer)

1. **Define transformer?**

   Transformer is a static machine which transfers electric power from one circuit to another circuit without a change in its frequency.

2. **Briefly explain the principle of operation of transformers.**

   A transformer consists of two coils which are in mutual inductance. When AC supply is given to one of the coils, an alternating flux is set up, which is linked with the second coil. Due to this alternating flux there is a mutually induced emf produced in the second coil. If the second coil is closed, current flows in it and so electric energy is transferred magnetically from the first coil to the second coil.

3. **What are the parts of a transformer?**

   The transformer has mainly following parts.
   - Primary winding – the coil to which the AC supply is given
   - Secondary winding – the coil from which output is taken and given to load.
   - Laminated Core – this acts as a mechanical support to the coils as well as provides magnetic path for the flux.

4. **What are the types of core in transformer?**

   There are two types of core in transformer
   - Shell type
   - Core type

5. **What is an ideal transformer?**

   An ideal transformer is the one which has no losses i.e., its windings have no ohmic resistance, there is no magnetic leakage and hence which has no I^2R and core losses. The efficiency of an ideal transformer is 100%.

6. **Give the emf equation of the transformer.**

   The emf induced in the transformer is given by

   $$E_1 = 4.4.4\, f\, N_1\, \phi_m$$
   $$E_2 = 4.4.4\, f\, N_2\, \phi_m$$

   Where, E_1 *is the emf induced in the primary winding.*
   E_2 *is the emf induced in the secondary winding.*
   N_1 *is the number of turns in the primary winding.*
   N_2 *is the number of turns in the secondary winding*
   ϕ_m *is the maximum flux produced.*
   f *is the frequency in Hz.*

7. **What are the losses occurring in a transformer.**

   The losses occurring in a transformer are

   a) Core loss – loss occurring in the core of the transformer. This has two components.
      - Hysteresis loss – The loss occurring due to the magnetization characteristics of the core.
      - Eddy current loss – The loss occurring due to the eddy current produced in the core.

b) Copper loss (I^2R loss) – loss occurring in the windings of the transformer. This has two components.
   - Primary copper loss – The loss occurring due to the current flowing through the primary winding.
   - Secondary copper loss – The loss occurring due to the current flowing through the secondary winding.

8. **What are the components of primary no-load current?**

The primary no-load current consists of mainly two components. They are,

a) Magnetizing current (I_m) – Produces flux in the core and hence magnetizes the core.

b) Core loss component current (I_c) – compensates for the core losses.

9. **What is the purpose of laminating the core in a transformer?**

To reduce the eddy current loss in the core of the transformer.

10. **Does transformer draw any current when secondary is open? Why?**

Yes, it (primary) will draw the current from the main supply in order to magnetize the core and to supply for iron and copper losses on no load. There will not be any current in the secondary since secondary is open.

11. **Define voltage regulation of a transformer?**

When a transformer is loaded with a constant primary voltage, the secondary voltage decreases for lagging PF load, and increases for leading PF load because of its internal resistance and leakage reactance. The change in secondary terminal voltage from no load to full load expressed as a percentage of no load or full load voltage is termed as regulation.

12. **Define all day efficiency of a transformer?**

It is computed on the basis of energy consumed during a certain period, usually a day of 24 hrs. all day efficiency=output in kWh/input in kWh tor 24 hrs.

13. **Why transformers are rated in kVA?**

Copper loss of a transformer depends on current & iron loss on voltage. Hence total losses depends on Volt-Ampere and not on PF. That is why the rating of transformers are in kVA and not in kW.

14. **What are the typical uses of auto transformer?**

- To give small boost to a distribution cable to correct for the voltage drop.
- As induction motor starter.

15. **What is the turns ratio and transformer ratio of transformer?**

Turns ratio = N_2/ N_1

Transformer ratio = $E_2/E_1 = I_1/ I_2 = K$

UNIT 02 (AC Machines)

1. **What are types of 3- phase induction motor?**
   - Squirrel cage induction motor
   - Slip ring induction motor
2. **What is slip of an induction motor?**

The slip speed expressed as the ratio of synchronous speed is defined as slip.

Percentage slip S=Ns-N/Ns*100

3. **Why the rotor slots of a 3-phase induction motor are skewed?**

The rotor slots of a three -phase induction motor are skewed
   - To make the motor run quietly by reducing the magnetic humming
   - To avoid the locking tendency of the rotor
4. **Why the induction motor is called asynchronous motor?**
   - Since the induction motor runs always at a speed lesser than synchronous speed, it is called asynchronous motor.

5. **Mention different types of speed control of slip ring induction motor?**
   - By changing supply frequency
   - By changing the number of stator poles
   - By rotor rheostat control
   - By operating two motors in cascade
   - By slip recovery scheme
6. **Name the two windings of a single-phase induction motor.**
   - Running winding
   - Starting winding.
7. **What is the function of capacitor in a single-phase induction motor?**
   - To make more phase difference between the starting and running winding.
   - To improve the power factor and to get more torque.
8. **Give the names of three different types of single-phase motor.**
   - Split phase motor
   - Shaded pole motor.
   - Single phase series motor.
   - Repulsion motor.
9. **What is the use of shading ring in a pole motor?**

The shading coil causes the flux in the shaded portion to lag behind the flux in unshaded portion of pole. This gives in effect a rotation of flux across the pole face and under the influence of this moving flux a stating torque is developed.

10. **State any four use of single-phase induction motor.**
    - Fans,
    - Wet grinders,
    - Vacuum cleaners,
    - Small pumps,
    - compressors,
    - Drills
11. **What are the types of starters?**
    - Stator rheostat,
    - Autotransformer
    - Star to Delta switch
    - Rotor resistance starter.
    - D.O.L
12. **Mention the starter suitable for rotor side control (slip ring induction motor).**

Rotor resistance starter is the only starter used in the rotor side of three phase induction motor

13. **Mention the starter suitable for squirrel cage induction motor.**
    - Stator rheostat,
    - Autotransformer
    - Star to Delta switch
    - D.O.L
14. **What are the advantages of capacitor-start capacitor run motor**
    - High starting torque
    - High efficiency
    - High power factor
15. **Mention the applications of stepper motor**
    - Robotics
    - Computer peripherals
    - Facsimile machine
    - Aerospace

UNIT 03 (Alternator)

1. **What is an alternator**

   An alternator (or) AC generator is a synchronous machine which converters mechanical energy into electrical energy and produces alternating e.m.f

2. **What is the necessity for predetermination of voltage regulation?**

   Most of the alternators are manufactured with large power rating and large voltage ratings. Conduction load test is not possible for such alternators. Hence other indirect methods of testing are used and the performance can be predetermined at any desired load currents and power factors.

3. **What is the principle of an alternator**

   The alternator works on the principle of Faradays law of electromagnetic induction. Whenever a conductor links with a magnetic field either the conductor is moving (or) the field is moving, an e.m.f is induced in the conductor.

4. **Why e.m.f method called Pessimistic method**

   The value of voltage regulation obtained by e.m.f method is always more than the actual value; therefore it is called Pessimistic method

5. **Why is the stator core of Alternator laminated?**

   The stator core of Alternator is laminated to reduce eddy current loss.

6. **Why are Alternators rated in kVA and not in kW?**

   The continuous power rating of any machine is generally defined as the power the machine or apparatus can deliver for a continuous period so that the losses incurred in the machine gives rise to a steady temperature rise not exceeding the limit prescribed by the insulation class. Apart from the constant loss incurred in Alternators is the copper loss, occurring in the 3 –phase winding which depends on I^2R, the square of the current delivered by the generator. As the current is directly related to apparent – power delivered by the generator, the Alternators have only their apparent power in VA/kVA/MVA as their power rating.

7. **What are the causes of changes in voltage in Alternators when loaded?**

   Variations in terminal voltage in Alternators on load condition are due to the following three causes:

   - Voltage variation due to the resistance of the winding, R
   - Voltage variation due to the leakage reactance of the winding, X_t

8. **What are the main parts of Alternator?**

   - Stator core
   - Salient or non-salient rotor field winding
   - Rotor shaft
   - Bearings
   - Internal cooling Fan etc.

9. **Write down conditions for parallel operation of two Alternators?**

   Both the Alternator should have same

   - Voltage
   - Frequency
   - Phase difference(3 phase)

10. **Mention the different methods finding voltage regulation.**

    - Synchronous impedance method (EMF method)
    - Ampere turn method (MMF method)
    - ZPF method

11. **Mention different methods of synchronization of single phase alternator.**

    - Dark lamp method
    - Bright lamp method

12. **What are the advantages of having rotating field system?**

    - Better insulation

- Ease of current collection
- Increased armature tooth strength.
- More rigid construction
- Reduced armature leakage reactance.
- Lesser number of slip rings.

UNIT 04 (Electronics)

1. **What are the advantages of ICs over discrete circuits?**
   - Minimization & hence increased equipment density.
   - Cost reduction due to batch processing.
   - Increased system reliability
   - Improved functional performance.
   - Matched devices.
   - Increased operating speeds
   - Reduction in power consumption
2. **What is OPAMP?**

   An operational amplifier is a direct coupled high gain amplifier consisting of one or more differential amplifiers, followed by a level translator and an output stage. It is a versatile device that can be used to amplify ac as well as dc input signals & designed for computing mathematical functions such as addition, subtraction, multiplication, integration & differentiation
3. **List out the ideal characteristics of OPAMP?**
   - Open loop gain infinite
   - Input impedance infinite
   - Output impedance low
   - Bandwidth infinite
   - Zero offset, ie., $V_o=0$ when $V_1=V_2=0$
4. **Mention some of the linear applications of op – amps**
   - Adder,
   - subractor,
   - Voltage to current converter,
   - Current to voltage converters,
   - Instrumentation amplifier,
   - Analog computation,
   - Power amplifier, etc.
5. **Define slew rate.**

   The slew rate is defined as the maximum rate of change of output voltage caused by a step input voltage. An ideal slew rate is infinite which means that op-amp's output voltage should change instantaneously in response to input step voltage.
6. **What is the need for an instrumentation amplifier?**

   In a number of industrial and consumer applications, the measurement of physical quantities is usually done with the help of transducers. The output of transducer has to be amplified So that it can drive the indicator or display system. This function is performed by an instrumentation amplifier.
7. **List the features of instrumentation amplifier**:
   - low DC offset
   - low output impedance
   - high gain stability with low temperature co-efficient
   - high CMRR

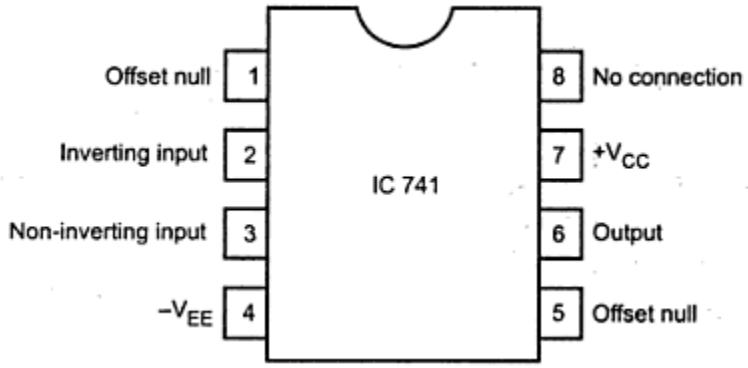
8. Define CMRR.

The ability of a differential amplifier to reject a common mode signal is expressed by a ratio called common mode rejection ratio denoted as CMRR

"The ratio of the differential voltage gain (A_d) to common mode voltage gain (A_c)"

$$\text{CMRR} = \rho = \left|\frac{A_d}{A_c}\right|$$

9. Draw the pin configuration of IC741.



10. Compare inverting and non-inverting amplifier.

Ideal inverting amplifier	*Ideal non-inverting amplifier*
Voltage gain = R_f / R_1	Voltage gain = 1+ (R_f / R_1)
The output is inverted with respect to input	No phase shift between input and output
The voltage gain can be adjusted as greater than, equal to (or) less than one	The voltage gain is always greater than one
The input impedance is R_1	The input impedance is extremely large

11. What are the D.C Characteristics of Op-amp?

- Input Bias current.
- Input offset current.
- Input offset voltage.
- Thermal Drift.

12. What are the A.C Characteristics of Op-amp?

- Slew rate.
- Frequency response.

UNIT 05

1. What are the applications of 555 Timer?

- Astable multivibrator
- Monostable multivibrator
- Missing pulse detector
- Linear ramp generator
- Frequency divider
- Pulse width modulation
- FSK generator
- Pulse position modulator

2. List the applications of 555 timer in Astable mode of operation:

- FSK generator
- Pulse-position modulator

3. List the applications of 555 timer in monostable mode of operation.

- ™ missing pulse detector
- ™ Linear ramp generator
- ™ Frequency divider
- ™ Pulse width modulation.

4. Define 555 IC?

The 555 timer is an integrated circuit specifically designed to perform signal generation and timing functions.

5. List the basic blocks of IC 555 timer?

- A relaxation oscillator
- RS flip flop
- Two comparator
- Discharge transistor.

6. List the features of 555 Timer?

- It has two basic operating modes: Monostable and Astable
- It is available in three packages. 8 pin metal can, 8 pin dip, 14 pin dip.
- It has very high temperature stability.

7. Define duty cycle?

The ratio of high output and low output period is given by a mathematical parameter called duty cycle. It is defined as the ratio of ON Time to total time

8. Explain the function of pin2 in IC555 timer?

The pin 2 is trigger pin. The inverting input of comparator 2 is brought out as trigger.it is compared with 1/3Vcc & when it is below this level, the output of the comparator 2 goes high which is given to reset input of R-S flip flop.

9. Explain the function of pin 5 in IC555 timer?

This pin is inverting input of the comparator 1.The voltage divider holds the voltage of this pin at 2/3Vcc.This is the reference level for the comparator 1 with which the threshold is compared. So generally external control voltage at pin 5 is not used. Only when the reference required is other than 2/3Vcc for the comparator 1 then it is used.

10. Which are the packages in which IC555 is available?

- Dual in line package
- Flat package

11. Compare monostable & Astable multivibrator.

Sl. No	Monostable multivibrator	Astable multivibrator
1	It has only one stable state	It has no stable state
2	Trigger is required for the operation	Trigger is not required for the operation
3	Two components R & C are required with IC 555 to obtain the circuit.	Three components R , R & C are required with IC555 to obtain the circuit

12. Define counter.

A counter is a register capable of counting the number of clock pulses arriving at its clock input. Count represents the number of clock pulses arrived. On arrival of each clock pulse, the counter is incremented by one. In case of sown counter it is decremented by one.

13. Define shift register.

The binary information (data) in a register can be moved from stage to stage within the register or into or out of the register upon application of clock pulses. This type of movement or shifting is essential for certain arithmetic and logical operations used in microprocessors. This gives rise to a group of registers called shift registers.

14. Mention the applications of shift registers.

- Delay line
- Serial to parallel converter
- Parallel to serial converter
- Pseudo random binary sequence generator
- Sequence detector

15. What is shift register counter?

A shift register can also be used as a counter. A shift register with the serial output connected back to the serial input is called shift register counter. The most common shift register counters are the ring counter and the Johnson counter.